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innovative waste solutions

# TECHNICAL MEMORANDUM NO. 5

**DATE:** June 29, 2016

**TO:** Jeff Coles, Recycling and Trash Collection Director
City of Fayetteville, AR

**FROM:** Robin Mitchell, Project Manager

**SUBJ:** Commercial Food Waste Pilot

**PROJ #:** 173-00.00

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## 1. Introduction

Kessler Consulting, Inc. (KCI) was contracted by the City of Fayetteville, Arkansas (City) to assist in developing a Solid Waste Reduction, Diversion, and Recycling Master Plan (Master Plan) with the objective of diverting 80% of the waste stream from the landfill. As part of this Master Plan, KCI assisted the City in planning and conducting a commercial food waste composting pilot (Pilot) to determine the feasibility of a citywide commercial food waste collection and composting program.

Specific goals of the Pilot included:

- Evaluate food waste collection logistics, including both onsite collection and transportation to the compost facility.
- Evaluate the Modified Static Aerobic Pile (MSAP) method for composting food waste at the City's compost facility.

## 2. Methodology

### 2.1. Pilot Site

This City owns and operates a 3.1-acre composting facility, which prior to this Pilot was composting only residential and commercial yard waste. In 2015, the City estimated it processed nearly 7,000 tons of yard waste. All food waste collected in the Pilot was transported to this facility for composting. This site was sufficient in size and infrastructure for conducting the Pilot without any physical modifications.

### 2.2. Operating Plan and State Approval

Prior to implementing the Pilot, KCI and the City prepared an Operating Plan as specified under Arkansas Pollution Control and Ecology Commission Regulation 22, Chapter 8. The City submitted the Operating Plan to Arkansas Department of Environmental Quality (ADEQ) seeking approval to

temporarily operate its Type Y (yard waste) composting facility as a Type O (source separated organic waste) composting facility.

In November 2015, the City and ADEQ signed a Memorandum of Agreement (MOA) to allow for 90 day operation of a Type O facility for the Pilot. This was later extended to 180 days following an inspection by ADEQ personnel, during which no issues were found. The MOA required all material to be moved offsite by 30 days after the 180-day pilot period.

The Pilot was limited to 10 tons of food waste per week. Food waste was collected over 21 weeks, from January 20, 2016 through June 10, 2016. This allowed sufficient time for all material to be composted, screened, cured, and moved offsite by August 17, 2016.

## 2.3. Participants

The City reached out to a number of commercial food waste generators to voluntarily participate in the Pilot. Table 1 shows the list of participants in the Pilot. At some locations, collection of both pre- and post-consumer food waste was not logistically feasible.

**Table 1: Pilot Participants**

| Business/Institution | Sector Type | Types of food waste collected | Carts provided |
|---|---|---|---|
| **University of Arkansas*** | University | Pre- and Post-consumer | 10 |
| **Happy Hollow Elementary School** | School | Post-consumer | 3 |
| **Greenhouse Grill**** | Restaurant | Pre- and Post-consumer | 1 |
| **Woodstone Pizza**** | Restaurant | Pre- and Post-consumer | 1 |
| **Khana Indian Grill** | Restaurant | Pre- and Post-consumer | 2 |
| **Farmer's Table** | Restaurant | Pre- and Post-consumer | 1 |
| **Starbucks** | Restaurant | Pre- and Post-consumer | 1 |
| **Arsagas** | Restaurant | Pre- and Post-consumer | 1 |
| **Fayetteville Senior Activity and Wellness Center (Senior Center)** | Recreational Center | Pre-consumer | 1 |

*Food waste was collected from 4 locations at the University of Arkansas: Fulbright/Northwest Quad, Pomfret Hall, Union Kitchen, and Brough Commons.
**Food waste from Greenhouse Grill and Woodstone Pizza was collected together.

## 2.4. Collection

The City worked with each participant to ensure they had the infrastructure in place for their staff and/or customers/students to source separate the food waste in their kitchen and/or dining room for. In most cases, participants used buckets, garbage cans, or other large containers for in-house collection containers. The City also designed and produced a poster to educate staff and customers/students about the Pilot and what can and cannot be included in the food waste (Figure

1). For this Pilot, food waste included any pre- and post-consumer food waste (except for raw meat) and compostable or food-soiled paper.

**Figure 1: Educational Poster for the Pilot**


The City provided each participant with 64-gallon roll carts for collecting food waste from the in-house containers. The number of carts provided to each participant is shown in Table 1 and was based on the volume of waste estimated at each location and feedback from the participant. The City serviced these carts 3 times per week using an automated side-load truck. At each stop, the driver estimated the volume of food waste collected based on the percentage of each cart that was filled. The driver also monitored for contamination (i.e. non-compostable material) and rejected carts with excessive contamination.

To maintain cleanliness and reduce odor, participants either rinsed the carts or used compostable bags to line their carts. The Senior Center and Happy Hollow Elementary did not have the capabilities to rinse the carts, so the City provided them with 64-gallon and 96-gallon compostable bags for their carts. KCI obtained the bags from 4 different manufacturers (Biobag, Natur-Tec, Bio-Tuf, and Ecosafe), as samples at no cost, all of which are certified compostable by the Biodegradable Products Institute (BPI). Starbucks and Khana Indian Grill provided their own compostable bags to line the carts. Khana Indian Grill used bags from Biobag, while Starbucks used compostable bags from IPS Industries, which to the best of KCI's knowledge is not listed by BPI. City staff monitored how well the bags composted.

### 2.5. Participant Survey

The City and KCI developed a survey to receive participants' feedback on the Pilot. Towards the end of the Pilot, the survey was emailed to each participant via Survey Monkey.

### 2.6. Composting

All food waste collected from participants was transported to the City's compost facility located at 1560 South Happy Hollow Road.

For the Pilot, KCI worked with the City to implement the MSAP composting method, instead of the traditional turned windrow method they had been using for yard waste composting. The MSAP method was developed by Harvest Quest International, and relies on a proprietary microbial inoculant that expedites the composting process and minimizes turning requirements.

In the MSAP method, the City first laid down a bed of ground yard waste, on top of which it tipped the food waste collected that day (Figure 2).

**Figure 2: Tipping Food Waste at the Compost Facility**

Photo credit: City of Fayetteville

Additional fresh yard waste was added to obtain a ratio of 3 parts yard waste to 1 part food waste. The City's windrow turner then mixed the material (Figure 3), which also broke open the compostable bags to facilitate their decomposition.

### Figure 3: Windrow Turner Mixing Food Waste and Yard Waste

Photo credit: Russell Cothren, Edible Ozarkansas

After mixing, a front-end loader began constructing the pile (Figure 4). Because of the limited amount of food waste collected in the Pilot, the City constructed weekly pile rather than elongated windrows.

### Figure 4: Pile Construction


Photo credit: City of Fayetteville

On Friday, after the third collection of the week, the inoculant was added on top of the mixed material (Figure 5).

### Figure 5: Adding Inoculant onto the Pile

Photo credit: Russell Cothren, Edible Ozarkansas

Then a 6-inch capping layer of ground yard waste was added on top of the pile, which essentially acts as an insulating blanket to facilitate the growth of the inoculant and maintain high temperatures throughout the pile (Figure 6).

### Figure 6: Adding the Capping Layer onto the Pile

Photo credit: City of Fayetteville

After capping, the inoculant spread across the surface of the pile underneath the capping layers. As the microorganisms in the inoculant grow and multiply, they siphon air into the pile, biologically simulating mechanical aeration of a static pile. The pile remained static for 30 days, at which point the City turned it with a front-end loader (Figure 7). The pile was then static for an additional 15 days until it was turned a second time. After 15 more days, the composted material was screened.

The screened compost then cured for an additional 14 days before distribution. Screen overs were then returned to be used in future piles as the base layer or capping layer.

### Figure 7: Mixing the Pile


Photo credit: Russell Cothren, Edible Ozarkansas

## 2.7. Monitoring

The primary indicator of effective active composting is high temperatures. High temperatures are also required to meet state and federal regulatory requirements for pathogen reduction. With the MSAP composting method, the surface of the compost (i.e. below the cap) must be above 131°F for 3 consecutive days and for 15 consecutive days in the interior of the pile. City staff monitored temperatures daily using a 4' manual temperature probe (Figure 8). Temperatures were recorded at depths of 12", 24", 36", and 48".

### Figure 8: Manual Temperature Probe

Photo credit: Russell Cothren, Edible Ozarkansas

Odor was monitored empirically by City staff while onsite. Any odor issues were identified and recorded by type, strength, and possible source.

### 2.8. Testing

Approximately halfway through the Pilot, the City pulled samples of finished (screened and cured) compost to submit to Midwest Laboratories for quality and regulatory testing using the procedures outlined in the Operating Plan. Pursuant to state regulations, Type O compost must be tested for the following parameters:

- Soluble salts (electrical conductivity)
- Fecal coliform
- Salmonella
- pH
- Arsenic
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Molybdenum
- Nickel
- Selenium
- Zinc

For the Pilot, the City tested the finished compost following the United States Composting Council (USCC) Seal of Testing (STA) program guidelines. This included testing for the above parameters as well as a number of other compost quality parameters.

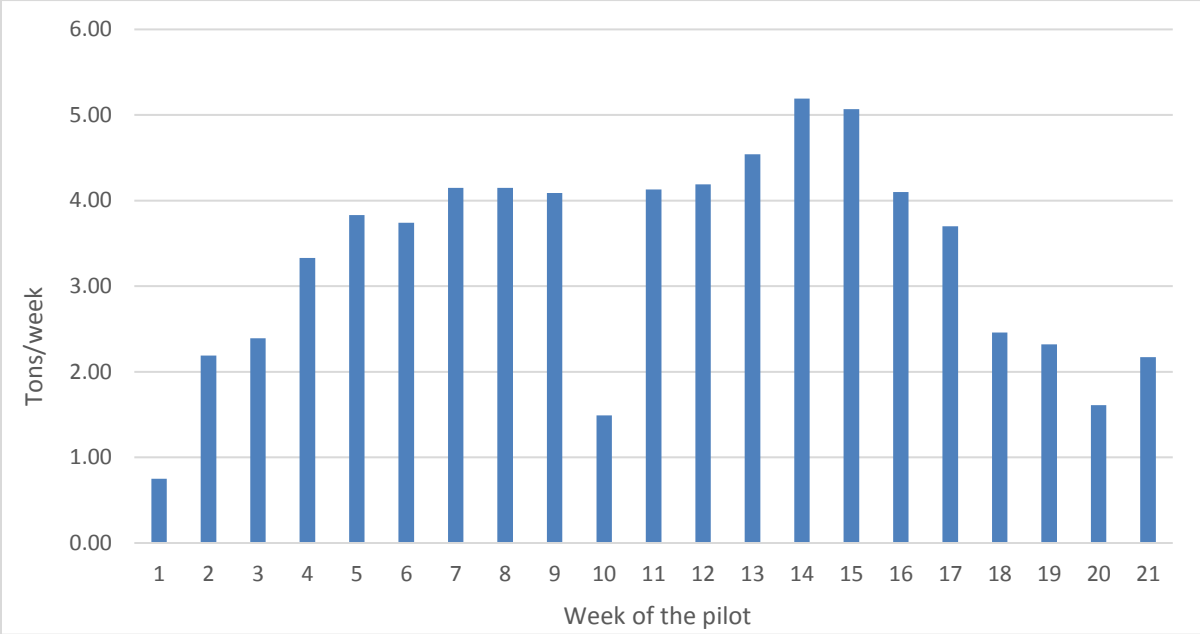
The City also pulled samples of fresh feedstock material (food waste and ground yard waste) to test for fecal coliform.

## 3. Results

### 3.1. Collection Results

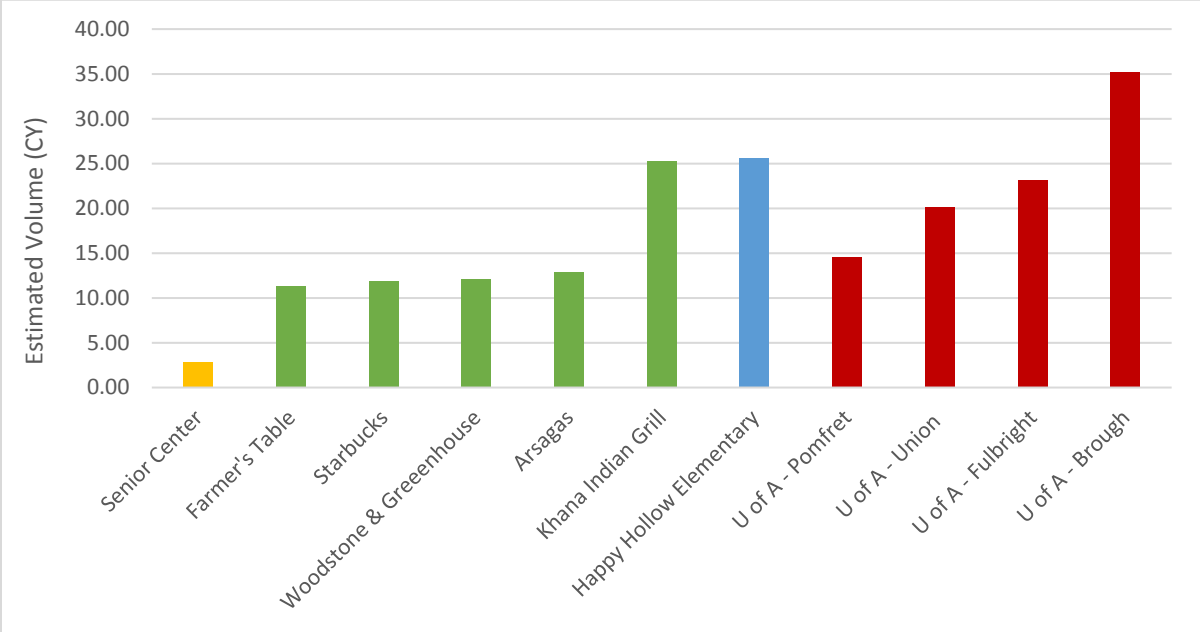
A total of 69.3 tons of food waste was collected during the Pilot, as measured by the City's scale house. Figure 9 shows the total tonnage of food waste collected during each week of the Pilot. After the initial ramp up in tonnage during the first few weeks, tonnages remained fairly consistent at 3-5 tons/week, with a few exceptions. A dip occurred in week 10 during spring break at the University. Weekly tonnages declined after week 17, when only minimal food waste was collected from the University as it entered the summer term. Concurrently, in early May, Arsagas and Starbucks were no longer collecting food waste, as they were under the impression the Pilot had ended.

### Figure 9: Weekly Tonnage of Food Waste Collected During the Pilot




Approximately 195 cubic yards (CY) of food waste was collected during the Pilot, as estimated by the City's driver during collection. Figure 10 shows the cumulative estimated volume of food waste collected from each participant. The University of Arkansas had the largest volume of food waste with a total of 93 CY for all four locations, the most significant volume coming from Brough Commons (35 CY). Happy Hollow Elementary School and Khana Indian Grill both had the second largest volumes of food waste (25 CY each), while between 11 and 13 CY were each collected from the other restaurants. The smallest volume was collected from the Senior Center (3 CY).

### Figure 10: Cumulative Estimated Food Waste Collection by Participant During the Pilot




Notes: U of A = University of Arkansas. Colors represent type of participant.

The driver noted that carts occasionally contained garbage and did not collect these carts. Out of a total of 682 potential pickups in the pilot, 16 incidents occurred where carts were rejected due to contamination. Most of these incidents were early in the Pilot and were corrected by communicating with the participant.

The City collected food waste 3 times per week to ensure sufficient service to the participants. Some participants did not require this frequency of service. For example, the Senior Center on average only placed their cart out once per week.

### 3.2. Participant Survey Results

The City received responses from all 9 participants in the Pilot. Below is a summary of the results of this survey:

- All participants rated their experience as positive or somewhat positive.
- While most participants experienced no issues with the Pilot, a few participants expressed minor issues, including needing more carts, not having sufficient space for carts or collection containers, odor, people not properly sorting food waste, having to rinse carts, or issues with the compostable bags.
- Some suggestions from participants to make food waste collection easier included more roll carts, more frequent collection, assistance with employee and customer training and marketing materials, City-provided in-house collection containers, and use of compostable bags.
- Nearly all participants received positive feedback from their employees, including:
    - "They are all very excited for this program to start full-time."
    - "They have talked about how easy it is and how much they like that this compost material is staying out of a landfill."
    - "Very user friendly."
- More than half of the participants noticed a change in their employees' behavior and greater awareness of food waste.
- Nearly all participants advertised the Pilot to their customers or students, mostly with a poster, sign, or by word of mouth. Some advertised on their website or social media.
- Most of the participants received positive feedback from their customers, including:
    - "Lots of positive feedback from customers on social media, it is well supported in our community."
    - "They like that we are a part of the program. They gained a lot of respect for us as a company that we were doing this."
    - "Very educational for the students."
- Two participants said some customers were confused about the compost program.
- One restaurant noticed more customers using take-out containers.
- Most participants estimated they decreased the volume of disposed garbage by 25-50% during the Pilot, while two participants estimated their waste reduction was more than 50%.

- All participants would continue to collect food waste if it was at no additional cost or if the cost was offset by a decrease in garbage collection costs. Two participates would continue if it cost 10% more.
- All participants would support a citywide mandate requiring food waste separation by businesses generating a substantial amount of food waste.
- Some additional feedback from the survey, included:
    - "The whole experience was positive for our business. Composting food waste will be nothing but beneficial for the city and the environment. It really is the only smart option."
    - "We are keeping our fingers crossed that the program can become a permanent part of Fayetteville Waste."
    - "Thank you for including FPS in the food waste Pilot and including the opportunity for students to tour the compost facility! We're hopeful this expands and all schools can participate in the future."
- After the survey, participants provided additional comments through email, including:
    - "I just wanted to say thanks for all your efforts in initiating this Pilot Program. We're keeping our fingers crossed that commercial food waste collection can become a permanent part of the Compost Program; we need it and the city and citizens of Fayetteville need it too."
    - "We would really like this program to continue, please be in touch if there is anything we can do to make this happen."

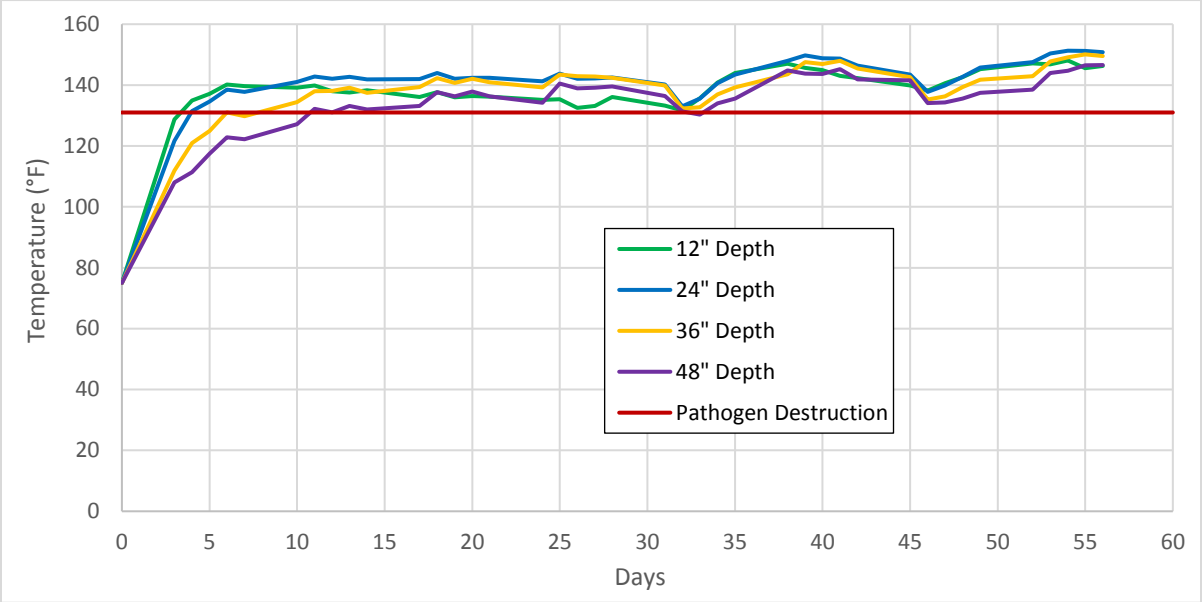
### 3.3. Compost and Monitoring Results

Because of the volume of food waste collected weekly during the Pilot, the composting operation outlined in the Operating Plan was slightly modified. Instead of constructing windrows of 35-40 feet in length, the 3-5 tons of food waste that was collected weekly was placed in round piles approximately 15-20 feet in diameter at the base. Turning these piles with the windrow turner was not feasible; therefore a front-end loader was used.

The modified operations did not appear to affect the compost process. The City was able to achieve a mix ratio of approximately 3 parts ground yard waste to 1 part food waste by volume in most piles, which is the ideal mixing ratio for the MSAP process.

Additionally, all piles met regulatory temperatures for pathogen reduction, which indicates robust composting conditions. Figure 11 shows the average temperature at each depth across all piles. This figure also clearly shows the spike in temperature after turning the pile at 30 and 45 days, indicating that using the front-end loader provided sufficient mixing.

**Figure 11: Average Temperatures for all Piles in the Pilot**




Throughout the Pilot, only one incident of major contamination (2 bags of trash) occurred onsite. The contamination was removed and disposed of. The City also reported a few occasions of soda cans in the food waste; these were easily removed by hand prior to composting. This low amount of contamination can be accredited to both the willingness of the participants to train their employees and customers/students and the drivers monitoring for contamination at the point of collection.

The City experienced minor issues with the compostable bags at the compost facility. When the windrow turner was used to mix the fresh material, the City noticed that the bags were not easily shredded by the turner and some bags became tangled on the drum of the turner. These needed to be periodically removed from the turner. The City also observed some remnants of bags when the compost was screened. Possible reasons for the last issue include:

- Participants used bags that were not certified compostable.
- Participants inadvertently placed plastic bags in their food waste carts that were not caught by the collection driver or at the facility.
- Certified compostable bags did not break down. This could potentially have resulted from the small pile size in the Pilot, which had more surface area than a larger windrow. A larger surface area means more bags could be at the surface of the pile and not break down as quickly. Also, because the piles were turned with a front-end loader rather than a windrow turner, the bags were not shredded to a great extent in the subsequent turnings.

No remnants of bags were found in the finished compost, indicating the screening process effectively removed these bag remnants.

City staff reported only minor odor issues. Near piles #3 and #4, the City experienced some ammonia odors during composting, which are often an indication of low carbon to nitrogen (C:N) ratios. In fact, these two piles had the lowest yard waste to food waste ratios in the Pilot (2.74 and 2.38, respectively), which could have resulted in low C:N ratios. No odors were detected offsite and no odors were at a severity to be problematic or require corrective actions.

### 3.4. Laboratory Test Results

Table 2 shows the results of the laboratory test for pathogens in the fresh feedstock and finished compost. Fecal coliform and *Salmonella* levels were below detection limits in the finished compost, clearly indicating that the MSAP compost process effectively eliminated pathogens.

**Table 2: Test Results for Pathogens in Fresh Feedstock and Finished Compost**

| Parameter | Units | Fresh feedstock | Pilot food waste compost | Allowable limits |
|---|---|---|---|---|
| ***Salmonella*** | MPN/4g dry weight | Not tested | <0.01 | 3 |
| **Fecal Coliform** | MPN/g dry weight | 95,000 | <0.2 | 1,000 |

MPN = most probable number. Allowable limits are from Table 2 of ADEQ Reg. 22 for Type O and S compost.

Table 3 shows the heavy metal concentrations in the compost. These heavy metal levels were significantly below the allowable state regulatory limits.

**Table 3: Test Results for Heavy Metals in Finished Compost**

| Parameter | Pilot food waste compost | Allowable limits |
|---|---|---|
| **Arsenic** | 3.03 | 41 |
| **Cadmium** | None detected | 39 |
| **Chromium** | 14.3 | 1200 |
| **Copper** | 19.4 | 1500 |
| **Lead** | 12.8 | 300 |
| **Mercury** | None detected | 17 |
| **Molybdenum** | None detected | 54 |
| **Nickel** | 6.0 | 420 |
| **Selenium** | None detected | 36 |
| **Zinc** | 81.9 | 2800 |

All units are in mg/kg dry weight. Allowable limits are from Table 2 of ADEQ Reg. 22 for Type O and S compost.

Table 4 shows the test results for nutrient concentrations in the finished compost both on an as is and dry weight basis. The macro and micro nutrient levels indicate a nutrient rich compost product. Most of the nutrient levels fall within the acceptable range for garden compost as defined by Woods End Laboratory.

### Table 4: Nutrient Analysis of Finished Compost

| Parameter | Pilot food waste compost (as is) | Pilot food waste compost (dry weight) | Accepted range (dry weight) |
|---|---|---|---|
| **Nitrogen** | 1.20% | 2.56% | 1.0 - 4.0% |
| **Organic Nitrogen** | 1.18% | 2.51% | N/A |
| **Ammonium Nitrogen** | 0.025% | 0.053% | <0.03% |
| **Nitrate Nitrogen** | <0.01% | - | 0.01 - 0.25% |
| **Phosphorus (as $P_2O_5$)*** | 0.30 | 0.64 | 0.2 - 2.3% |
| **Potassium (as $K_2O$)*** | 0.49 | 1.05 | 0.1 - 2.4% |
| **Sulfur** | 0.11% | 0.23% | N/A |
| **Calcium** | 1.74% | 3.71% | 0.5 - 10.0% |
| **Magnesium** | 0.14% | 0.30% | 0.1 - 1.0% |
| **Sodium** | 0.90% | 0.19% | < ½ of potassium |
| **Iron** | 2,500 ppm | 5,333 ppm | < 12,000 ppm |
| **Manganese** | 477 ppm | 1,017 ppm | <1,000 ppm |
| **Boron** | <20 ppm | | N/A |
| **Copper** | 9.1 ppm | 19.4 ppm | <350 ppm |
| **Zinc** | 38.4 ppm | 81.9 ppm | 400 - 2,800 ppm |

*Fertilizer labeling expresses % phosphorus and % potassium as %$P_2O_5$ and %$K_2O$, respectively, but these nutrients are not necessarily in this chemical form in the product.
Accepted ranges are derived from the compost matrix scorecard for garden compost provided by Woods End Laboratory.

Table 5 shows various agronomic parameters of the finished compost, as well as preferred and acceptable ranges according to the USCC's Consumer Compost Use Program. Most parameters were within the preferred or acceptable range. The only unfavorable result was a low percent of seed emergence. While there are a number of reasons why the emergence may be low, this should not present any serious problems with the compost given the positive results with every other parameter. Simply curing the compost for additional time may resolve this low emergence number.

### Table 5: Agronomic Parameters Analysis

| Parameter | Units | Pilot food waste compost | Preferred | Acceptable | Notes |
|---|---|---|---|---|---|
| **Stability** | mg $CO_2$-C per g OM per day | 0.29 | <2 | <4 | The lower the number, the more completely composted the product. |
| **Maturity** | % seed emergence & vigor | 50% emergence 97% vigor | 90-100% | 80-100% | The higher the percentage, the more versatile the product. |
| **Moisture Content** | % wet weight basis | 53.12% | 40-50% | 35-65% | Products with higher moisture content may be used. They may simply be more difficult to apply. |
| **Organic Matter** | % dry weight basis | 69.97% | ≥35% | ≥25% | Creating a soil containing 5%-10% organic matter is desirable in typical, well drained soils. |
| **Particle Size** | Screen size to pass through | 3/8” | See note | See note | Desired particle size depends on usage:<br>• Lawn topdressing: 1/4"-3/8”<br>• Planting: 3/8”-1/2”<br>• Mulch: 1”-2” |
| **pH** | pH units | 7.8 | 6.0-7.5 | 5.5-8.5* | Modify soil pH, if necessary, based on soil testing results. |
| **Soluble Salts (Electrical Conductivity)** | dS/m (mm-hos/com) dry weight basis | 3.0 | <5.0 | <15.0 | Keep in mind that most soluble salts are also plant nutrients. Compost containing a higher soluble salt content should be applied at lower application rates and watered in well. |
| **Physical Contaminants** | % dry weight basis | None detected | <0.5% | <1.0% | Small stones may be deemed more acceptable than man-made inerts (e.g. plastic) |

* Table 2 of ADEQ Reg. 22 requires pH to be between 5.5 and 8.5 for Type O and S compost.
The above table is derived from information developed for the USCC’s Consumer Compost Use Program.

Table 6 shows comparisons between the test results of food waste compost produced during the Pilot and the City’s yard waste-only compost for parameters that were tested on both composts. The food waste compost had lower heavy metals, higher phosphorus, higher organic matter, and more neutral pH compared to the yard waste compost. Seed emergence was higher in the yard waste compost, but, as mentioned previously, this was likely due to the food waste compost needing to cure for longer. Direct comparison is cautioned, however, because these are single sampling times and the composts were tested at different laboratories.

### Table 6: Comparison between Food/Yard Waste and Yard Waste Only Compost

| Parameter | Units | Pilot food waste compost | Yard waste compost |
|---|---|---|---|
| **Cadmium** | mg/kg dry weight | None detected | 6.1 |
| **Chromium** | mg/kg dry weight | 14.3 | 105.2 |
| **Copper** | mg/kg dry weight | 19.4 | 40 |
| **Nickel** | mg/kg dry weight | 6 | 20.1 |
| **Zinc** | mg/kg dry weight | 81.9 | 142 |
| **Nitrogen** | % | 2.56% | 2.34% |
| **Phosphorus (as $P_2O_5$)** | % | 0.64% | 0.38% |
| **Potassium (as $K_2O$)** | % | 1.05% | 1.42% |
| **Calcium** | % | 3.71% | 6.44% |
| **Magnesium** | % | 0.30% | 0.37% |
| **Sodium** | % | 0.19% | 0.07% |
| **Iron** | ppm | 5,333 | 4,963 |
| **Manganese** | ppm | 1,017 | 254 |
| **Maturity** | % seed emergence & vigor | 50% emergence 97% vigor | 93% emergence 96% vigor |
| **Organic Matter** | % dry weight basis | 69.97% | 58.80% |
| **pH** | pH units | 7.8 | 8.25 |
| **Soluble salts (Electrical Conductivity)** | dS/m (mm-hos/cm) dry weight basis | 2.98 | 1.8 |

## 4. Findings and Conclusions

The Pilot demonstrated the effectiveness of the MSAP method for composting commercial food waste at the City's compost facility.

- **Quality compost:** The temperature profiles indicated a healthy compost system and the laboratory tests showed a high quality, clean compost.
- **Faster composting:** The MSAP method provided a faster composting process than the turned windrow method currently used by the City, which requires 4-6 months. Using the MSAP method for composting food waste and yard waste, active compost required only about 60 days. Faster composting time allows more material to be processed on the existing site.
- **Less turning:** Because the inoculant pulls air into the windrow, fewer turnings were required compared to the turned windrow method, which requires about 12 turns on average for a full composting cycle. The MSAP method only required 2 turns per cycle.
- **Odor control:** The MSAP method appeared to successfully control odors. Turning a windrow often has the highest potential to release odors. Because the MSAP method only required 2 turnings and the first turning did not occur until after day 30, the potential for odor release was reduced. In addition, the capping layer is intended to act as an in-situ biofilter to prevent releases of odors during active composting.

- **Potential cost savings:** The cost of the MSAP inoculant should be more than offset by the reduced labor, operational, and maintenance costs as compared to traditional turned windrow composting. Potential costs savings will be examined by KCI in a forthcoming financial analysis.

The Pilot provided valuable information and important considerations regarding composting operations when implementing a permanent food waste composting program.

- **Compostable bags:** To avoid having to clean out food waste containers, many businesses will likely want to use some form of compostable bag as a container liner. During the Pilot, some bag remnants were found in the compost prior to screening. Full-scale operation with larger windrows (less surface area) and additional shredding by using the windrow turner instead of a front-end loader to turn the piles should help minimize these remnants. Additional actions to reduce bag remnants include: 1) ensure only certified compostable bags or bags that are proven to be compostable at the City's facility are used and 2) ensure adequate participant/employee education and training to prevent plastic bags from being placed in the carts.
- **Windrow turner:** While the City's windrow turner is acceptable for the MSAP method, a larger turner may be beneficial. The larger turner will create larger windrows to allow more compost material on the current site. Larger windrows will generate more heat, thereby enhancing the compost process. In addition, a windrow turner with a larger diameter drum might be less likely to have compostable bags tangle on it.
- **Thermometer:** Temperature monitoring is required to meet state requirements for Type O composting facilities. In the Pilot, the City was using a manual thermometer, which required a dedicated staff member for monitoring. An automated temperature monitoring system could significantly reduce labor costs associated with temperature monitoring.
- **USCC's STA program**: The STA program is a voluntary, nationally recognized testing certification program that gives assurance to the end-user that the compost is tested using certified methods at a certified laboratory. Under the program, compost would need to be tested either once per quarter or every other month, depending on the amount of compost produced. While the City is not currently a participant in the STA program, joining the program could be beneficial. Labeling the compost as STA-certified could enhance the marketability and value of the compost. If the City establishes a full-scale food waste composting program, the quantity of compost produced will increase, and the STA program could help the City to distribute and sell this compost.

The Pilot also provided valuable information regarding collection of food waste.

- **Controlling contamination:** This is undoubtedly the most important and challenging aspect of a food waste collection program. As demonstrated by the Pilot, it will require appropriate education and training for participants, as well as possibly assisting participants in training employees. In addition, it would be helpful for collection crews to spot check for contamination, especially at the start of the program and for new customers, and reject carts with excessive contamination.
- **Customized service level:** As with commercial waste collection service, the number and size of containers and frequency of food waste collection will need to be tailored to the customers' needs. Businesses that generate food waste throughout the week will likely want multiple collections weekly.

- **Collection costs**: Cost is clearly a factor in determining whether a business will participate in a food waste composting program. Providing food waste collection has a cost. The cost to a business can be offset to some extent by right-sizing the business' waste collection service, and the cost of this service, to reflect the smaller amount of non-putrescible waste to be collected after food waste is removed. Another option is to develop an "all-in" rate structure that includes all services to be provided to businesses, e.g., garbage, recycling, and food waste collection.
- **Focus on large food waste generators**: Large commercial food waste generators should be targeted first if the City decides to implement a permanent food waste composting program. This would include grocery stores, restaurants, and schools. During the Pilot, Happy Hollow School was one of the best participants with regular cart set-out, no contamination issues, and high volumes of material. The University of Arkansas was the largest food waste generator in the Pilot, but has indicated they may be making other arrangements for collection and processing of their food waste.

In conclusion, the Pilot was successful in meeting all of its objectives. It demonstrated the success of the commercial food waste collection system and the effectiveness of the MSAP method in composting these materials. Based on the Pilot results, pursuing a full-scale program appears warranted and will be further evaluated as part of the Master Plan process. The City now has staff trained in both collecting food waste and using the MSAP process to compost food waste. The success of this Pilot is underlined by the fact that the City is already in the process of applying for a Typo O permit for its compost facility that will enable the acceptance and composting of food waste.